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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/511,212	10/13/2004	Steven T Peake	GB 020048	2126
24737	7590	08/10/2005	EXAMINER LEE, EUGENE	
PHILIPS INTELLECTUAL PROPERTY & STANDARDS P.O. BOX 3001 BRIARCLIFF MANOR, NY 10510			ART UNIT 2815	PAPER NUMBER

DATE MAILED: 08/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/511,212

Applicant(s)

PEAKE, STEVEN T

Examiner

Eugene Lee

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 October 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

1. This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required.

Claim Objections

2. Claims 1 thru 14 are objected to because of the following informalities: in line 16 of claim 1, a word is missing between "each" and "two"; in line 4 of claim 2, a word is missing between "range" and "10um", in line 3 of claim 10, a word is missing between "range" and "10¹⁹"; and in line 5 of claim 10, a word is missing between "range" and "10¹⁸". Appropriate correction is required.
3. Claims 4 thru 14 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim should refer to other claims in the alternative only and/or cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims have not been further treated on the merits.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1 thru 9, and 11 thru 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Darwish et al. 5,688,725 in view of Kocon et al. 6,351,009 B1. Darwish discloses (see, for example, FIG. 11G) a vertical trench MOSFET (vertical power transistor trench-gate semiconductor device) comprising a semiconductor body, active area, plurality of electrically parallel transistor cells, gates (trench- gates) 102, N+ source regions (source regions) 112, N-drift region (drain regions) 111, P body (channel-accommodating region) 116, and deep P+ region (ruggedness regions) 114. Darwish does not disclose source regions and the ruggedness regions ... as alternating stripe areas having a width perpendicular to and fully between each of two adjacent parallel stripe trench-gates. However, Kocon discloses (see, for example, FIG. 3C) trench gates 307 alternating in between P+ body regions 302, and N+ source regions 306. In column 5, lines 1-5, Kocon discloses that such an arrangement exploits the advantage of device size reduction. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have source regions and the ruggedness regions ... as alternating stripe areas having a width perpendicular to and fully between each of two adjacent parallel stripe trench-gates in order to exploit the advantage of device size reduction.

Regarding claim 2, Darwish in view of Kocon does not disclose the cell pitch being less than 2 um, and wherein the length of the source region stripes being in the range 10 um to 50 um. However, it was well within the skills of an artisan in the art to optimize the performance of a semiconductor device by adjusting the cell pitch and length of source region stripes in order to have an array of cells adequately operating in a reduced space. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the cell pitch being less than 2 um, and wherein the length of the source region stripes being in the range 10

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um to 50 um because it was well within the skills of an artisan to optimize the performance of a semiconductor device by adjusting the cell pitch and length of source region stripes in order to have an array of cells adequately operating in a reduced space. See *In re Aller*, 105 USPQ 233.

Regarding claims 3-9, the limitations contained in claims 3-9 are functions of the cell pitch, and optimized in the same manner as the paragraph above.

Regarding claims 11, and 12, Darwish in view of Kocon does not disclose the doping concentration of the ruggedness regions being approximately 10 times greater than the doping concentration of the source regions, and the doping concentration of the ruggedness regions being about 10^{21} cm^{-3} and the doping concentration of the source regions being about 10^{20} cm^{-3} . However, it was well within the skills of an artisan in the art to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to provide a semiconductor region that can adequately conduct a current from the source to the drain in a vertical trench MOSFET. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the doping concentration of the ruggedness regions being approximately 10 times greater than the doping concentration of the source regions, and the doping concentration of the ruggedness regions being about 10^{21} cm^{-3} and the doping concentration of the source regions being about 10^{20} cm^{-3} because it was well within the skills of an artisan to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to form a semiconductor regions that can adequately conduct a current from the source to the drain. See *In re Aller*, 105 USPQ 233.

Regarding claim 13, see, for example, FIG. 11G wherein Darwish discloses the deep P⁺ region extending further into the drift region 111 than the gates 102.

Regarding claim 14, see, for example, column 2, lines 32-36 wherein Darwish discloses the breakdown voltage being likely 60 volts or less (drain-source breakdown voltage of the device is in the range up to about 50 volts).

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Darwish et al. '725 in view of Kocon et al. '009 B1 as applied to claims 1-9, and 11-14 above, and further in view of Mo 6,316,806 B1. Darwish in view of Kocon does not disclose the semiconductor body being silicon. However, Mo discloses (see, for example, column 3, lines 40-44) a semiconductor device comprising a silicon wafer 44 wherein a trench is formed therein. It would have been obvious to one of ordinary skill in the art at the time of invention to have the semiconductor body being silicon in order to adequately form semiconductor regions in a semiconductor device such as a MOSFET.

Regarding the limitation "the ruggedness regions have ... doping concentration in the range of 10^{10}cm^{-3} to 10^{22}cm^{-3} , and wherein the source regions have ... a doping concentration in the range of 10^{18}cm^{-3} to 10^{21}cm^{-3} . However, it was well within the skills of an artisan in the art to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to provide a semiconductor region that can adequately conduct a current from the source to the drain in a vertical trench MOSFET. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the ruggedness regions have ... doping concentration in the range of 10^{10}cm^{-3}

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to 10^{22} cm^{-3} , and wherein the source regions have ... a doping concentration in the range of 10^{18} cm^{-3} to 10^{21} cm^{-3} because it was well within the skills of an artisan to optimize the performance of a semiconductor device by adjusting the doping concentrations of the ruggedness regions and the source regions in order to form a semiconductor regions that can adequately conduct a current from the source to the drain. See *In re Aller*, 105 USPQ 233.

INFORMATION ON HOW TO CONTACT THE USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 571-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee
August 8, 2005

